Unclassified Paper

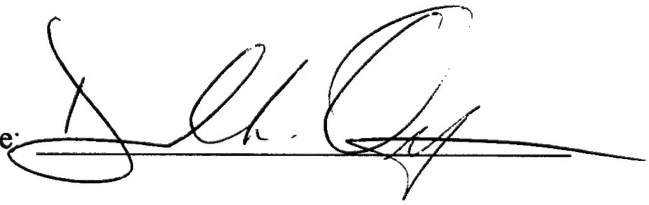
NAVAL WAR COLLEGE
Newport, R.I.

Losing Anti-personnel Landmines: An Economy of Force

David A. Ottignon
Major, U.S. Marine Corps

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

Signature: 

5 February 1999

Captain Grimord USN and LTC Townsed USA
Seminar 9

Advisor: Colonel W. J. Gibbons USMC

REPORT DOCUMENTATION PAGE

1. Report Security Classification: UNCLASSIFIED	
2. Security Classification Authority:	
3. Declassification/Downgrading Schedule:	
4. Distribution/Availability of Report: DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.	
5. Name of Performing Organization: JOINT MILITARY OPERATIONS DEPARTMENT	
6. Office Symbol: C	**7. Address:** NAVAL WAR COLLEGE 686 CUSHING ROAD NEWPORT, RI 02841-1207
8. Title (Include Security Classification): Losing Anti-personnel Landmines: An Economy of Force (U)	
9. Personal Authors: Major David A. Ottignon, USMC	
10. Type of Report: FINAL	**11. Date of Report:** 5 February 99
12. Page Count: 20	
13. Supplementary Notation: A paper submitted to the Faculty of the NWC in partial satisfaction of the requirements of the JMO Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.	
14. Ten key words that relate to your paper: Antipersonnel Landmines, Ottawa Treaty, Operational need, Operational Impact, Alternatives	

15. Abstract:

The 1997 Ottawa Conference recently banned anti-personnel landmines (APLM) and created international pressure for non-signatories such as the United States, to abide by its mandate. This paper will address the operational need for landmines. It examines the role of landmines as an economy of force in operational maneuver and flexibility, as well as their affects on the operational factors of war. It will explore the impact of eliminating landmines on the Korean peninsula and offer alternatives to the Operational Commander. The paper will argue that the elimination of landmines, without a proven and cost efficient alternative to APLM, creates a substantial capability gap and ignores the increased risk to U.S. Forces. Finally, it will briefly examine future systems under exploration to replace APLM that might offer the Operational Commander an alternative capability.

16. Distribution / Availability of Abstract:	**Unclassified**	**Same As Rpt**	**DTIC Users**
	X		

17. Abstract Security Classification: UNCLASSIFIED	
18. Name of Responsible Individual: CHAIRMAN, JOINT MILITARY OPERATIONS DEPARTMENT	
19. Telephone: 841-6461	**20. Office Symbol:** C

Table of Contents

Introduction

The 1997 Ottawa Conference banned anti-personnel landmines (APLM) and created international pressure for non-signatories such as the United States, to abide by its mandate. The one-year moratorium on APLM sponsored by Senator Patrick Leahy (D-Vermont) and recent Presidential Decision Directives have moved the United States one step closer to eliminating landmines in accordance with world opinion. Yet, APLM are a cost-effective method of influencing the operational factors of war. The Operational Commander benefits from the economy of force provided from APLM and its applications as a force multiplier. The impact of these constraints on the operational factors of space, time and forces significantly reduces the Operational Commander's ability to shape the battlefield.

This paper will address the operational need for landmines. It examines the role of landmines as an economy of force in operational maneuver and flexibility, as well as their affects on the operational factors of war. It will explore the impact of eliminating landmines on the Korean peninsula and offer alternatives to the Operational Commander. The paper will argue that the elimination of landmines, without a proven and cost-efficient alternative to APLM, creates a substantial capability gap and ignores the increased risk to U.S. forces. Finally, it will briefly examine future systems under exploration to replace APLM that might offer the Operational Commander an alternative capability.

The Ottawa Treaty

The formal process to ban APLM began in Geneva in 1980. Protocol II of Certain Conventional Weapons (CCW) addressed the indiscriminate use of mines and booby traps, but was not ratified until 1995. By this time, the Protocol had extended to cover internal armed conflicts, remotely delivered APLM that are not self-destructive (SD) or self-neutralizing (SN)

and instructions on responsibilities for marking and maintaining minefields. The Protocol did nothing to ban the use of APLM. Consequently, the Canadian government hosted a conference in December of 1997 to sign a comprehensive treaty to ban the use of APLM.

The Ottawa Treaty was a product of 121 countries and non-government agencies that opposed the indiscriminate and inhumane effects caused by APLM on non-combatants. It was signed on 4 December 1997. The Treaty's decree called for a ban on the use, development, production, acquisition, stockpiling and transfer of all APLM[1]. It further stipulated the removal of *all minefields* within ten years. The Treaty retains no means for enforcing the ban nor does it include the major powers (United States, Russia, China and the countries of South Korea, India, Pakistan and Israel).

U.S. National Policy

The United States withdrew from the Ottawa process in September 1997 stating concerns that banned scatterable mine systems (mixed mine munitions that contain both APLM and anti-tank (AT) mines) and the potential capability gap created by the lack of an alternative facing U.S. forces in Korea (USFK).[2] Despite this decision, US initiatives prior to this announcement appeared to be correlated with the Ottawa process. Presidential Decision Directive 48 of 16 May 1996 stated the US would aggressively pursue an international agreement to ban anti-personnel landmines (APLM). The directive indicated the U.S. would unilaterally cease using non-self-destructing APLM not needed for countermine training or the defense against armed aggression that crosses the demilitarized zone (DMZ) in Korea.[3] Also in 1996, a one-year moratorium on APLM passed into law. Sponsored by Senator Patrick Leahy (D-Vermont), the

---

[1] Vinson, Nigel. P-19.
[2] Fredenburg, Paul. P-7.
[3] Bier, Gregory. P-27.

moratorium begins 12 February 1999 and does not distinguish the difference between SD and non-self-destructing APLM. The result prohibits the use of mixed scatterable systems that contain SD APLM. Thus, the constraint placed on the use of APLM challenges the operational need for landmines and does not adequately address the ramifications of eliminating them without cost-effective alternatives.

In October 1997, the initiative announced as "Demining 2010" called for the removal of all APLM from over 64 countries. The National Security Council circulated a draft Presidential Decision Directive that is designed to force the U.S. into de facto compliance with the Ottawa Treaty.[4] In reality, U.S. policy towards APLM has shifted to deflect growing international pressure by agreeing to non-use of APLM despite earlier concerns.[5] Based on these decisions, it is reasonable to assume that in the near future all landmines will be banned.

The Operational Need

APLM are primarily used as an economy of force measure. This relatively inexpensive weapon system provides an excellent method of denying ground to the enemy. It can enhance the effects of other friendly weapons systems (direct and indirect) or provide early warning of enemy movement. The measure of effectiveness (MOE) for the utility of APLM lies in its ability to fix forces so that other weapons can increase their efficiency.[6] APLM affects initial force ratios, increases potential enemy casualties and produces psychological effects that create paralysis on an enemy's plans and operations. APLM acts as a force multiplier by enhancing operational maneuver and offering the Operational Commander flexibility in force employment and battlefield shaping. Their influence over the operational factors of war is significant and

---

[4] Bier, Gregory. P-27.
[5] Klemencic, John. P-8.
[6] Oneil, Pat. OVSD(A&T) S&TS-M Brief.

grants the commander various options of force deployment and employment, as well as risk management.

Operational Maneuver

APLM complement AT mines by minimizing their inherent weakness, disarmament by foot soldiers. Antipersonnel and antitank (AP/AT) minefields deter, delay, or disrupt, enemy force movement across the battle space. APLM contributes to this effect by nullifying the enemy's dismounted breach and forcing him to deploy his engineer assets while friendly weapon systems (direct/indirect) are brought to bear. While terrain specific, the Operational Commander retains his combat power forward by employing AP/AT scatterable minefields for flank security or to cover an enemy avenue of approach (AA).[7] This force multiplier allows friendly forces the ability to shape the battle space by restricting or controlling the enemy's maneuver while retaining the freedom of maneuver for positional advantage. As a result, the Operational Commander can apply the principles of war to influence enemy maneuver at the appropriate time and place to support his concept of operations and his own scheme of maneuver.

One could argue in light of the Ottawa Treaty that a "pure" AT minefield in sufficient depth and density would have the same effect as an AP/AT minefield. However, a pure AT minefield loses its advantage by its exposed weakness. Surface employed AT mines can easily be penetrated without its complementary mix of APLM. A mixed minefield increases the difficulty of breaching, increases the Commander's time to react without losing space and achieves a certain psychological affect against the enemy.[8] For this analysis we will consider APLM an integrated weapon with AT mines unless otherwise indicated.

---

[7] Integration & Development, MCCDC, working draft. P-2.
[8] TRADOC, ICP 97.

Operational Flexibility

APLM increases the Commander's flexibility to impede enemy maneuver while retaining the freedom to focus combat power. In defensive operations, APLM contribute significantly to force protection. In 1974, British combat engineers deployed APLM along a 53-kilometer line in the Dhofar campaign on behalf of the Sultanate of Oman.[9] A single battalion was capable of defending the wide front. In this case, APLM served as a force multiplier and economy of force thus enabling the Operational Commander to retain the flexibility of employing minimal forces necessary for mission success. During Desert Storm, scatterable mines protected special operation forces and provided the Operational Commander the flexibility to deploy forces in deep operations. Both General Stiner (CINCUSSOCOM) and General Downing (JTFSOC) agreed to the effectiveness of APLM for force protection at night and the psychological effects on the Iraqi Army.[10]

APLM provides the flexibility necessary for employing a mobile defense. The Operational Commander retains a multitude of options when analyzing operational factors. He can leave mobility corridors unattended and maintain an acceptable force ratio for close battle. The Commander can maintain a smaller reserve, increase the area of operations, and maintain the mobility necessary for defensive forces to attack enemy forces.

Conversely, mines can impose constraints on friendly maneuver. Since mines are indiscriminate, one could argue their constraints complicate movement and maneuver. However, the development of self-destructing (SD) and self-neutralizing (SN) scatterable mines helps facilitate passage of friendly lines and control over battle space. These systems offer the

---

[9] Vinson, Nigel, P-20.
[10] Lynch, J.D. P-47.

Operational Commander an ideal method of controlling the deep battle space as well as retaining the freedom of maneuver for operations in close contact with enemy forces.

Economy of Force

APLM are economical relative to the armored vehicle or foot soldier they are designed to destroy.[11] Landmines are extremely simple to operate and distribute, require little maintenance and afford the Operational Commander the option to deploy fewer soldiers. A recent "Alternatives to APLM" study, indicated that an increase in resources on the order of 30% would be required to make up the deficit of not employing APLM.[12]

In offensive operations, APLM integrated with AT mines allows the Operational Commander to deconflict the competing requirements for flank security and the main effort. Scatterable mines, as an economy of force, provide a powerful capability to respond to infiltration and attacks on Combat Service Support (CSS) logistic trains. APLMs employed at the tactical level for force protection create incremental benefits at the operational level for force deployment and employment. AP/AT mines *are the economical choice* for denying enemy ground.

Operational Factors

AP/AT mines are an integral part of the Operational Commander's ability to dominate battle space. Their capabilities enhance the Operational Commander's plans to shape rear, close and deep battlefield operations by integrating the effects of landmines with friendly fires (direct and indirect). AP/AT mines create depth by allowing the Operational Commander to defend large non-linear areas, reduce enemy mobility and reinforce exposed flanks during offensive operations.

---

[11] Vinsen, Nighel. P-19.

AP/AT mines are an economical choice for delaying enemy advances. Scatterable mines can be quickly employed, allowing the Operational Commander to regain the necessary time to respond to infiltration or penetration within the battle space. Commanders planning offensive and defensive operations with the use of AP/AT mines are granted more options when calculating space – time calculations against superior enemy forces.

When force structure is analyzed with space and time, the relationship between them reveals a unique option of operating in a large area with minimal forces. For example, the U.S. maintains roughly 37,000 soldiers in the vicinity of the DMZ in South Korea in accordance with the UN-brokered armistice.[13] These forces face a numerically superior North Korean Democratic People's Republic of Korea (NPRK). AP/AT minefields and the optional scatterable systems allow the Operational Commander to array his forces in a manner that minimizes the lopsided force ratios while simultaneously covering the avenues of advance and yielding him time to respond to any attack. Additionally, AP/AT are an effective tool in managing risk to forces deployed along the DMZ. The Operational Commander can defend with a nominal force and still minimize the loss of space for time.

Operational Impact

When employed correctly, APLM enhances the use of other weapons providing flexible options in mobility, counter-mobility and survivability of the force. The loss of this cost effective weapon system would significantly degrade the Operational Commander's ability to shape the battle space and increase the level of risk to friendly forces.

As an economy of force, the removal of APLM would require additional forces to achieve the same results. Take the hypothetical case of defending Turkey (a NATO ally) against

[12] Vinsen, Nigel. P-19

an invasion by Syria or Iraq over water rights along the Euphrates River. As allied force projection from the eastern Mediterranean across Turkey increases, so does the vulnerability to exposed flanks that run parallel to Syria's border. Unable to utilize the quick and lethal scatterable mines, the Operational Commander's force employment would require additional forces to cover the exposed flank and therefore diminish the combat power forward. The result of losing this capability would immediately be recognized. The Time Phased Force Deployment Data (TPFDD) would require significant reengineering. The provision for force protection and "killing" systems would require additional combat power to deploy earlier, increasing the strain on the already heavily laden surge lift capability.[14] Similarly, the increased need for barrier material would tax the operational function of logistics with competing needs between material and normal sustainment. More importantly, the level of risk would increase exponentially without the use of scatterable mine systems. As indicated earlier, APLM is an economical choice in defeating the armored vehicle or foot soldier. The increased risk to U.S. forces would be highly correlated to the increased cost of men and material in executing the operation.

In the abstract, the employment of AP/AT mines offers various options in which a Commander can exercise and reduce risk. The Commander has the option to employ mines for a desired effect. Whether it's increasing time in the defense phase, protecting flanks and AAs in the counter-offensive or enhancing force ratios, the Commander is given the flexibility to act and minimize risk. Their economical value make them hard to replace with alternatives that could run in the billions for research and development and fielding.[15] Unfortunately, current U.S. policy fails to recognize that without mixed landmine systems, unacceptable risks to U.S. forces

[13] Fredenburg, Paul. P-7.
[14] O'Donnell, James. P-1.
[15] Integration & Development, MCCDC, Information Paper. P-2.

are created that quite possibly jeopardizes successful execution of many OPLANs (Operation Plan) currently issued.[16]

Defending Korea

The OPLAN most affected by the loss of mines is South Korea. Landmines are currently employed in the vicinity of the DMZ. These defensive barriers are designed to slow an advance in order to allow sufficient U.S. force build up prior to counter-attack. Examining the terrain surrounding the DMZ reveals two main axes (15kms wide) of potential attack in the flat western part of the peninsula which are complemented by possibly 3 or 4 attack corridors in the central and eastern part of the country.[17] If a large NPRK army could mass undetected, we can assume its rate of advance would average 4 to 5 kilometers per day down these corridors.[18]

The Defense minus APLM

The battle for the Korean peninsula is postulated on U.S. and allied forces executing a defensive action while a major U.S. build up takes place to conduct counter-offensive operations.[19] The removal of AP/AT minefields covering the likely avenues of approach creates unacceptable risk to allied forces attempting to defeat advancing forces. The rate of advance for NPRK forces would increase significantly and could possibly reach 20 kilometers per day.[20] Army's Concepts and Analysis Agency (CAA) determined that losses would immediately increase by 10% without the use of mines. CAA also determined that additional forces would be necessary to offset the loss of mines.[21] A significant loss to the Operational Commander would be the early warning provided by landmines. Seoul, the capital city, is approximately 40

---

[16] Joint Staff Wash DC, msg 302020z Nov 98.
[17] O'hanlon, Michael. P-140.
[18] O'hanlon, Michael. P-148.
[19] O'hanlon, Michael. P-135
[20] Klemencic, John. P-13.

kilometers from the DMZ and is key to the defense of the country. Without the use of AP/AT mines, the Operational Commander would have insufficient time to implement the civilian evacuation plan and subsequently might not be able to hold the city.[22] The loss of Seoul would be a devastating blow both politically and militarily and have the effect of crippling American public resolve.

One could argue that given the restrictive terrain, the marginal benefits from mines are minimal. Existing defenses without AP/AT mines could capitalize on man-made features and other obstacles, such as prepared demolitions on bridges and tank ditching to block advances. Yet, each of these obstacles lack the lethality and the psychological effect created by mines. The argument of removing mines trivializes the necessary integration of mines for channeling the enemy into designated killing zones. Furthermore, they disregard increased level of risk to U.S. ground forces. The Operational Commander would be forced to increase his force deployment to compensate for the loss of firepower. Though detection sensors placed forward might provide early warning, they would contribute little in slowing the rate of advance. As the defense struggles to regain the initiative, Operational Commanders computing time and space factors would have found themselves short of both.

Alternatives

CINC USFK may have limited options to reduce their dependence on ALPM in the defense, but they come at a cost. The first option is to allocate more forces to the theater in the absence of landmines. A strong case could be presented that adjusts the end strength of USFK and subsequent follow-on forces. At the minimum an additional maneuver brigade, cavalry regiment and various tactical air support assets should be forward to reduce the risk in the halt

[21] Klemencic, John. P-11.

phase.[23] These forces would be necessary to offset the lethality that AP/AT mines contribute to the defense.

A second option would be to significantly increase the engineer effort along the DMZ. An additional engineer brigade would be required to augment existing tank barriers and counter-mobility obstacles to limit an NPRK advance. This would require an investment in time as defensive positions were constructed and improved. There are numerous rivers, marshes and other impediments within the DMZ region, which can be integrated into a barrier plan to channelize the advance to designated killing zones.[24]

A third option is to augment the batteries of MLRS (Multiple Launch Rocket System) in the theater.[25] The CINC of USFK could forward Program Objectives Memorandums (POM) to ensure the necessary force structure of indirect fire weapon systems. MLRS has proven itself a superior weapon system for massing fires at decisive points. Utilizing current sensor technology and Unmanned Aircraft Vehicles (UAV) to provide early warning, MLRS could be brought to bear at a decisive point and offset the loss of AP/AT mines that disrupt or fix an enemy in a designated killing zone. Yet, the Operational Commander would be left to resolve the need for MLRS fires to interdict advancing forces deep within the battle space versus the conflicting necessity of massing MLRS fires to shape killing zones within the close operational space.

Additional forces are one solution, however in light of the Pentagon's Quadrennial Defense Review (QDR) and Bottom-up Review (BUR); this option may be more difficult than at first glance. The dilemma clearly illustrates the economy of force that APLM and AT mines provide. Increasing the number of MLRS batteries is a more likely option, but it requires

[22] Fredenburg, Paul. P-7.
[23] Klemencic, John. P-11.
[24] O'Hanlan, Michael. P 140.

additional assets to be funded in future Department of Defense (DOD) budgets that are already strained by the necessity to modernize other weapon systems. A more likely alternative would be to augment current sensor technology with UAVs (Unmanned Aircraft Vehicle) to provide early detection of advancing forces. However, these systems alone clearly lack the lethality and psychological effect afforded by defensive belts integrated with AP/AT mines.

Future Capabilities

While current systems meet the operational requirements (serve as protective obstacles, protect AT mines, cover blind AAs and complement other obstacles), they remain a politically unacceptable weapon system.[26] To fill the capability gap, technology will have to replicate the affects of APLM and AT mines on the battlefield inexpensively, while simultaneously maintaining positive target discrimination. R&D initiatives have begun looking at both lethal and non-lethal alternatives that meet the mission essential capabilities of APLM and AT mines. Those capabilities include: operate in the full spectrum of war, enhance the effects of close and deep operational fires, provide a range of effects that inhibit mounted or dismounted maneuver, provide early warning of ground attack, and resist the full spectrum of enemy breaching methods including dismounted means.[27]

Lethal Systems

Many of the future systems will likely incorporate a sensor component linked to a lethal system that can maintain the psychological impact of APLM, as well as discriminate between combatant and non-combatant. This sort of battle override would allow Operational Commanders to enjoy the economy of force provided by mine barriers while conforming to the

[25] O'Hanlon, Michael. P 167.
[26] Integration & Development, MCCDC, APLR Draft ORD. P-1.
[27] Joint Staff msg. P-3.

theater's Rules of Engagement (ROE).[28] Area denial systems such as sensors linked to a "standoff" weapon system or UAV's equipped with scatterable mine munitions appear to be the current alternative. These systems would be able to provide situational awareness for the Operational Commander through sensors while maintaining the ability to launch munitions over the target. As technology improves, other variables such as Global Positioning Systems (GPS) would increase the likelihood of accurately targeting enemy formations within the kill zone.

The current technologies closest to becoming a reality are the "man-in-the-loop" systems that require positive identification of the target before detonation. For example, the Army Corps of Engineers is working on the Counter-Mobility Remote Control System (CIRCE). The CIRCE is a "man-in-the-loop" system that is a teleoperated system with fiber optic monitors that relay information back to an operator who has the decision to fire or not.[29] There are two major disadvantages with "man-in-the-loop" systems. First, this type of system employment increases the command and control (C^2) nodes in the battle space that are required for monitoring and activating the weapon system. The logistical support to deploy and maintain such a system is the second disadvantage to the Operational Commander.

Non-Lethal

The Department of Defense Non-Lethal Program is currently funding a number of projects that have the potential for replacing APLM. Many of these systems are most likely to be deployed at the tactical level, but are nevertheless significant for the Operational Commander in Operations Other Than War (OOTW). The Modular Crowd Control Munitions (MCCM) would employ rubber pellets in a Claymore mine configuration to disrupt combatants. Another technology being explored is the Active Denial System. This system would utilize directed

[28] CG, MCCDC Comments on HQMC (RPA-1C) of 18 May 98.

energy to repel intruders. These alternatives all have potential and may provide a near-term, low-tech, low-cost solution in meeting the requirements of APLM.[30]

Non-lethal weapons will never replace the psychological affect attributed to AP/AT mines. The synergistic effect of combining non-lethal weapons with lethal force may provide a unique capability to the situational Commander, but it will ultimately fail to meet the objectives of the Operational Commander who must contend with both close and deep operations.

Recommendations

Early estimates to acquire an acceptable alternative to landmines have been tagged at $5 billion.[31] Despite recent political demands for increasing the DOD budget, finding an alternative to APLM would ultimately compete with other weapon systems deemed critical for the modernization of the force. U.S. policy appears to not only ignore the enormous cost associated to replace the capability of landmines, but the unpalatable risk associated with the loss of landmines.

An alternative that would minimize the cost and risk associated with the loss of landmines, but require a stiff political backbone, is to retain the use of SD and SN mines. Many of the landmines targeted by the Ottawa Treaty and world opinion are the "dumb" mines that are neither SD nor SN. Most professional armies now employ APLM within FASCAM (Family of Scatterable Mines), which utilizes the SD/SN fusing.[32] These SD/SN weapons such as ADAM/RAAM (Area Denial Artillery Munitions/Remote Anti-Armor Munitions) offer the Operational Commander the ability to fix or disrupt enemy mobile armored movement within the deep operational space. Forces in Korea would retain the ability to significantly slow advancing

[29] Green, Bryan. P-13.
[30] DOD NLW APL Alternative Brief 97.
[31] Integration & Development, MCCDC, Working draft. P-2.

forces, complement barrier obstacles and reduce their risk exposure. U.S. policy should acknowledge the ban on "dumb" landmines, but rigorously defend the necessity to deploy FASCAM for force protection. While not politically popular, it is the most cost-effective method to enhance force employment. It recognizes the need to ban "dumb" landmines while simultaneously taking advantage of existing technology. Furthermore, it supports a capable force in light of current force structure and future QDRs. Current PDDs have directed DOD to eliminate the AP mix in FASCAM by 2003.[33] This decision disregards the indispensable capability of APLM as a force multiplier and the requirement for force protection and should be reversed.

Conclusions

It is likely that the success of the Ottawa Treaty will extend itself to banning all landmines. U.S. policy should continue to support the removal of "dumb" landmines, but strongly resist international pressure for removing SD/SN fuses from its arsenal. Scatterable mine systems are state of the art and negate many of the arguments forwarded by the Ottawa Conference. Current and future defense budgets make this the wisest alternative with the most benefits for a military superpower charged with defending U.S. interests abroad.

A search for alternatives to landmines will require them to match the success of current AP/AT mine systems and be inexpensive to manufacture. Likewise, it will be necessary for these alternatives to match the psychological effect of APLM to achieve similar success. Without a course change in U.S. policy or proven alternatives, ground forces will be at increased risk and will arguably suffer larger casualties. By the same token, a substantial force

[32] Fredenburg, Paul. P-5.
[33] J-8 LLWAD Brief, Dec 97.

augmentation would be necessary to offset the lost capability of AP/AT mines. This option might not be feasible in the era of budget and force structure restraints. [34]

When Operational Commanders evaluate the factors of space – time – forces, they will see their options drastically reduced without landmines. Their ability to shape the battle space will diminish as the requirements for forces to protect flanks deplete the combat power required for the main effort. The freedom of maneuver and flexibility will be degraded from the lack of mines and warning times will decrease as reactionary forces attempt to respond to advancing forces. The ultimate loss will be the economy of force provided by the employment of APLM. This relatively inexpensive force multiplier is excellent at denying ground to the enemy, fixing forces and producing a psychological effect that can create paralysis on enemy plans and operations. The capability gap created by the loss of landmines should not be trivialized. Its loss will increase the risk exposure to U.S. forces, undoubtedly require a costly alternative and ultimately demand additional forces to compensate for its lethality.

[34] Integration & Development, MCCDC, Working draft. P-2.

Bibliography

Army Concepts and Analysis Agency, Information Briefing, Anti Personnel Landmine Study. May 1997.

Banerjee, Dipankar. Eliminating Anti-Personnel Landmines. Asian Defense Journal. March 1998.

Beir, G.L. Anti-personnel Landmine Policy and Implications. Engineer. April 1998.

Department of Defense. Non-Lethal Weapons Program. NLW and APL Alternatives Briefing Slides. 1997.

Fredenburg, P.W. Major. Banning of the Anti-personnel Landmine. Canadian Defense Quarterly. Vol 27, No. 2. Winter 1997.

Green, Bryan. CPT USA. Alternatives to anti-personnel mines. Engineer. Dec 1996.

Klemencic, John. LTC USA. United States Policy for Anti-Personnel Landmines. Army War College. 12 Jan 1998.

Lynch, J.D. Jr. MGEN (Ret.). Landmines, Lies, and other Phenomena. U.S. Naval Preceedings. Vol 124, No. 5. May 1998.

Lutz, George. Anti Personnel Landmine Alternatives Program. Working Integration Product Team Briefing Slides. 10 February 1997.

Joint Staff Washington DC. MSG Traffic 302020Z Nov 98. Worldwide Conference for Mixed Landmine Systems Alternatives Minutes Message.

J-8, Land & Littoral Warfare Assessment Division. Anti-Personnel Landmine Alternatives Update Briefing Slides. JRB/JWCA CINC Trip. Dec 1997.

MCCDC. CG Comments on HQMC (RPA-1C). Review of Battlespace Shaping and Force Protection Against Personnel Threats MNS Revision. 18 May 1998.

Meadows, Sandra I. Defense Technologists Engineer Blitz Against Global, Buried, Slient Killers. National Defense. Nov 1997.

O'Hanlon, Michael. Stopping a North Korean Invasion: Why Defending South Korea is Easier than the Pentagon Thinks. International Security. Spring 1998.

Oneil, Patrick. OVSD (A&t) S&TS-M Anti-personnel Landmine Alternative Study Briefing Slides. 16 Jan 1997.

Sengupta, P.K. Neutralizing mines through technology. Asian Defense Journal. Mar 1998.

Schultz, John. Major USMC. Weapons Integration Development. MCCDC APL-R. 1997.

Taylor, E.B. Building a Minefield Database System. Engineer. Dec 1996.

TRADOC APL Alternative Integrated Concept Team. Preliminary Assessment. 1998.

Vinson, Nigel. Demise of the Anti-personnel Mine: A Military Perspective. RUSI Journal, Vol 143, No. 1. Feb 1998.

Willis, G.E. Defense vs. Offense: Landmines. Army Times. Vol 58, No. 46. 15 June 1998.